MAYAN ARCHITECTURE

by

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INTRODUCTION

This work deals with the architecture of Classic Maya, with an introduction to the civilization which created it. The Mayas made spectacular progress in agriculture, art, mathematics, writing, and architecture. They became the first great civilization of North America. Their entire culture was the result of a unified religion with little, if any, outside influence.

The earliest known recorded Mayan date is equivalent to 320 A.D., and the last date of the Classic period is 909 A.D. References to Pre-classic and Post-classic periods are used only to establish the line of development and later the decadence of the Classic era.

Chichen Itza is probably the most familiar Mayan City. The Mayas built and abandoned this city during the Classic era and resettled there in 965 A.D. Much of what is written and illustrated regarding Chichen Itza is Toltec-Mayan and developed after 1200 A.D.

By the time the Spanish arrived in 1517, the Mayas had fallen under the influence of the Toltecs and/or civil unrest. Their great cities had been abandoned for seven centuries. The first written account of Mayan life was by Friar de Landa who arrived in Yucatan in 1549 and set about to destroy all heathen gods and abolish the native religion. In so doing, he destroyed some 4000 Mayan books and images. De Landa's conduct in Yucatan brought about his recall to Spain and his book was written for self-defense. His book, entitled "Relacion de las Cosas de

Yucatan", ("On the Things of Yucatan") wasn't known until 1863 when it was found in the Spanish Royal Academy.

In the late 1830's, John Lloyd Stephens, an American traveler, diplomat, and archeologist, and Frederick Catherwood, an English artist, ventured into Central America. Stephen's book with excellent lithographs by Catherwood is the first published work in English of the ruins of Maya. The two works entitled "Incidents of Travel in Central America, Chiapas and Yucatan" (Harper and Brother, New York, 1841) and "Incidents of Travel in Yucatan" (Harper and Brother, New York, 1843) created international interest in Central America. Each work is done in two volumes.

During the past century numerous individuals and organizations have carried on archeological and anthropological investigations of the Mayan civilization. These studies have, with few exceptions, been concentrated on specific subjects in which architecture was of only secondary importance.

The purpose of this study was to establish an understanding of construction techniques and architectural details which made up the architecture of the Mayan civilization.

Research for this work consisted of the study of published work pertaining to the Mayas. numerous letters to authorities throughout the United States and Mexico, and 31 days of travel of which one day was spent at the Middle American Research Institute at Tulane University, New Orleans, and 27 days of research at 12 ancient sites in Mexico. During the Mexican visit, officials of the Instituto Nacional de Antropologia E Historia

graciously granted interviews and did everything possible to give assistance.

CULTURE

During the ten centuries previous to the birth of Christ, the Mayan Indians emerged from barbarism and began the formation of a great culture. By the beginning of the Christian era, they had reached a stage of development for a self-contained civilization in which writing, astronomy, mathematics, and the arts reached a high order.

The Mayas occupied most of British Honduras, Guatemala, Tobasco, Chiapas, the western part of Honduras, and El Salvador, plus all the states of Campeche, Quintana Roo, and Yucatan. The central area is tropical rain forest. Yucatan is a low limestone country and has a drier climate. In southern Guatemala the country is mountainous.[1]

The origin of the Mesoamericans in which the Mayas reached the highest development and the later desertion of their great cities are two unanswered mysteries. Several hypotheses exist for each of these questions, but definite proof has evaded all searchers.

Regardless of their origin, a very long development period must have been required during which agriculture was developed to a point where the possession of a food supply permitted the

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[1]See Plate I, page 51, for a map of Classic Maya.

culture to evolve. During this period there must have been a gathering of hunting groups, a long period of domestication and cultivation of food plants, a phase for establishing villages and distributing all basic materials, and finally a period of specialization.

The earliest known recorded Mayan date is inscribed on a jade plaque (Leyden Plate) found on the Atlantic coast of Guatemala and corresponds to 320 A.D. The earliest dated monument is a stela (sculptured stone shaft) which carries a date equivalent to 328 A.D. This monument is located in Uaxactum in the lake Peten district of Guatemala.[1] This does not necessarily mean that Uaxactun is the oldest Mayan city since other cities have stelae of almost equal antiquity. A large number of uncarved stelae suggest that in earlier times dates were painted on.[2]

There is ample evidence of a long occupation of cities prior to the erection of any known dated monuments.

The Government and the People

The government of Maya was theocratic, but applied to city-states rather than a unified nation. There is no evidence that the far-flung network was ever under a unified political control.[3] Each large city and surrounding area apparently was

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[1]For pronunciation of place names, see page 49.

[2]J. Eric S. Thompson, "The Civilization of the Mayas," p. 13.

[3]C. L. Hay and others, "The Maya and Their Neighbors," p. 162.

independently governed by its own nobility. The evidence indicates the Mayan culture was closely bound together by commonly shared religious ideals rather than a central government.

The lands were communally owned; no person was permitted to own property in his own name. Land was measured in units called kan which is about 400 square yards and probably based on an area 20 paces square. (This unit is still in use today among Indian tribes in remote areas of Central America.) Each family was allotted a piece of land for its dwelling. The area of farm land was determined by the individual's ambition.

The nobility lived within the cities while the common people lived in villages outside the cities nearer to their fields. The dwellings of the common people were of the same general nature as the nobility, but of poorer construction and were not stuccoed as the better class homes were.

Many Mayan families owned slaves. In times of famine, persons convicted of stealing suffered the punishment of slavery.

The cities were the centers of justice and common people resorted to these centers for the administration of justice. Imprisonment was unknown. Slavery was frequently the punishment, although fines were imposed and the families of the guilty banded together to post bail. Offenses against family morality, unnatural vice was punished by burning alive. Unintentional homicide was punishable by a fine.

Population

The population consisted primarily of the noblemen, including the priests and the common people. A few occupations, such as merchants and artists, were carried out by craftsmen; but nearly everyone else not of nobility were farmers.[1] Mayan society was never integrated. The nobility and the common people were separated by their caste and training. Commoners built the houses of the nobility and had to work on their plantations. They were also required to give a percentage of the game from hunting trips and a share of their salt.

Estimates of the total Mayan population during the Classic period vary greatly. A heavy population must have resulted from the long period of security.[2] To build and maintain the tremendous urban works required a large number of people. The people must have been required to devote months of labor each year to the building of their cities. The total population during the Classic times is estimated between 6 and 7 million people, though references can be found where the estimates run to 13 million.[3] Today the population of the entire area is less than 3 million persons.

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[1]J. Eric S. Thompson, "The Civilization of the Mayas," p. 72.

[2]C. L. Hay et al., "The Maya and Their Neighbors," p. 164.

[3]Interview with Dr. Alfredo Barrera Vasquez, Director, Instituto Nacional De Anthropologia E Historia, Merida, Yucatan, Mexico. Also Oliver G. Ricketson, Jr. and Edith Mayles Ricketson, "Uaxactun, Guatemala, Group E," p. 15.

The leveling of hills, quarrying of stone, and moving of materials was probably done by 100-man work forces. One work gang could not move more than 60 tons of material per day. This represents about 1000 cubic feet of limestone rubble and about 1600 cubic feet of earth. The Governor's palace at Uxmal, for example, contains approximately 4,000,000 cubic feet of fill and masonry. It is obvious that many work forces were required to work simultaneously in order to build all the temples, palaces, and other projects executed during the Classic period.

If we can assume that one 100-man work team could move and place 1000 cubic feet of material per day, it would take 4000 days to build the Governor's palace.

Water

To any civilization, rain is needed to grow crops and replenish ground water. Throughout the entire Mayan area the rain god, Chac, becomes an important part of the art and architecture.

Throughout the northern part of the Yucatan Peninsula drinking water was a major problem for the Mayas. In the Peten Lake region the valleys were once lakes and at Uaxactun and Tikal the valleys were actually paved to assure a water supply. The land area north of Rio Bec the Chenes (well country) and Puuc (hill country) had underground cisterns, called chultunes, and natural wells, called cenotes, to furnish drinking water.

The Peten district is hilly and during the rainy season, the valleys became lakes. Their cities are referred to as

"Island Cities" because they were built on the summits of knolls or hills. Extensive study of this area indicates a population density of 270 persons per square mile during the peak of the Classic period. Today the Peten area is almost uninhabitable because of the scarcity of drinking water.[1]

Cities in the area of the Usumacinta and Motagua Rivers were assured of continuous water supply by these dependable rivers.

Commerce

Merchants were banded into guilds which enjoyed diplomatic immunity and traveled under the patron god, Cacao. Mistreatment of merchants was considered a serious crime and a pretext of war, at least among the Mexicans and probably the Mayas.

Main items of trade were obsidian, jade, copper, salt, pottery, etc. Sea shells are frequently found in cities many miles inland and must have been an item of trade. The cacao bean was the universal currency. Slaves were an item of trade to Tobasco for these prized beans. Salt was also an extremely important commodity in areas lacking natural deposits of salt. In these areas salt was acquired by trade or by a journey of many days to a natural deposit where salt was available.

Cities that had salt deposits under their control had a terrific economic advantage in that they could "fix" the price of

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[1]George Kubler, "The Art and Architecture of Ancient America," p. 120.

this essential commodity and economic war was not unheard of. Trading was carried out on both land and sea. It is possible that Yucatan carried on trade with islands in the Caribbean.[1] Frescoes in The Temple of Jaguars at Chichen Itza dated 1191 A.D. show large canoes and marine scenes. By objects found in Panama and Yucatan it is certain that trade existed between these two countries.

Inland trade followed established routes with rest stops at intervals. Long stone roads (called sacbes) link cities of eastern Yucatan, while in the Peten Lake district and western Yucatan shorter stone roads link various cities. Since the Mayas had no wheeled vehicles or beasts of burden, it is supposed that these roads existed primarily for religious processions.

Very little concerning markets within the cities has been recorded. Much of what is known is centered at the time of the Spanish conquest. The greatest market place known to the Spanish was at Chichen Itza. Within the so-called Thousand Column group is an area which Landa referred to as the "mercado". This area is a square with tall round columns which resemble Greek Doric more than Mayan or Mayan-Toltec. These columns are still standing. No evidence of masonry vaults or end walls would suggest that this market had a wood and thatch roof system instead.

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[1]C. L. Hay and others, "The Mayas and Their Neighbors," p. 428.

Agriculture

The Mayan system of agriculture was a primitive system known as milpa. The head of a household selected a parcel of forest for cropland. The growth was cleared away and the brush burned. Usually new land was selected each year as second year crops from the same field did not yield well. Cultivated ground was allowed to lie fallow for a period of 6 to 10 years. The clearing and burning pattern was then repeated. If milpa agriculture is practiced continually in any forested area, the land will eventually support only grasses and a heavy sod will result.[1] The milpa system is still used in the forest areas where the limestone ledge and thin soil covering rule out mechanical implements. In these remote areas, the way of life and dwelling types have changed little in the past two thousand years.

Since the Mayas had no implements with which to turn the sod, they had to move to regions still forested which they could cultivate. Their only alternative was to escape to new lands that they could cultivate. The agricultural collapse may have been one of the reasons for the abandonment of the great cities.

Indian corn (maize) was virtually the "staff of life" of the Mayas. The only plant known that will cross with maize, producing various corn-like hybrids, is a grass known as teosinte. Some place in unrecorded antiquity, maize was derived by cross-breeding with teosinte, a plant native only to the Middle

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[1]J. Eric S. Thompson, "The Civilization of the Mayas," p. 18.

Americas.

Unlike the Europeans, the Mayas used a pointed stick to form a hole in the ground into which a few seeds were placed. During the preparing of the lands, planting and harvesting, they worked in co-operative groups of 16 to 20 families. Each phase of agriculture was preceded by religious ritual in which the priests prayed to a patron god who had jurisdiction over the occasion.

In addition to maize, squash, beans, pepper, tomatoes, and sweet potatoes, numerous fruits were cultivated and consumed by the Mayas. Meat consisted of wild game. A variety of hairless dogs were raised for eating. Turkeys were domesticated, as was a stingless honey bee. Honey was chiefly employed in making a ceremonial drink called balche, which was mildly intoxicating.

Cotton was raised in large quantities for clothing and export. Yucatan enjoyed a reputation for fine cloth which was traded to areas to the south. The cacao bean held a unique position in that it was the universal currency throughout the civilization of Maya and could also be roasted, ground, and boiled with ground maize to make a cereal. From the cacao seeds a margarine was made which was used in a large number of Mayan dishes. Consumption of cacao beans in Yucatan was so great that large quantities had to be imported from Tobasco.

A method of preserving maize was by soaking the grain, removing the kernel, grinding it between millstones, and then rolling it into balls which would keep several months.

Religion

The Mayan religious rituals and some ceremonies had a superficial resemblance to certain rites of the Roman Catholic Church.[1] This caused some of the early Spanish explorers to believe that St. Thomas had brought the gospel to the new world. However, there is no evidence to support such a theory.

Worship as congregations within buildings could not have been practiced. Their temples were usually placed on top of pyramids which had impressive stairways and had very few rooms.[2] The priests probably used the chambers to impress the lay people and to set them apart from themselves. The people were spectators rather than participants in religious ceremonies. One can imagine the throngs in the courts and plazas watching the colorful pageantry, watching the priests ascend the stairways and disappear into the temples. The splendor of the rituals is clearly shown by the fantastically rich costumes sculptured on stelae, painted on the pottery vessels, and by scenes such as shown in the Bonampak murals.[3] Religious ceremonies attracted swarms of people who were as much attracted by social intercourse and trading as by the religious aspects.

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[1]Thomas Gann and J. Eric S. Thompson, "The History of the Maya," p. 139.

[2]A. Ledyard Smith, "Uaxactun, Guatemala: Excavations of 1931-1937," p. 12.

[3]An excellent color illustration of a Bonampak mural is shown in "Time Magazine", October 25, 1963, p. 79.

The Mayas performed an act of baptism which seemed to the early Spanish friars proof of their contention that St. Thomas had preached in the new world. In addition, the Mayan word used for this ceremony meant "rebirth". However, contrary to Roman Catholic practice, the children were not baptized until they were about twelve years old. The baptismal ceremony was an occasion for a feast for the whole community. The parents of the child gave notice to the priest, who selected a lucky day. Others in the community who had children of age to be baptized were invited. The house and grounds were swept clean and purified so that all evil was driven out before the ritual began.

Books

Only three Mayan books (called codices) are known to exist today.[1] They consist of a single strip of parchment made from vegetable fiber strengthened by a natural gum substance and coated with lime. Onto this surface priests laboriously inscribed hieroglyphics, coloring them with vegetable and mineral paints. The manuscript was folded and enclosed between wooden or leather covers making a single volume, or codex, not unlike a modern book in appearance.

The finest is known as the Dresden Codex and is in the public

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[1]Thomas Gann & J. Eric S. Thompson, "The History of the Maya," p. 15.

library in Dresden, Germany.[1] The second codex is in Paris and the third copy, which is two volumes, is in Spain. The subject matter of all these codices deals with astronomical calculations.

Calendar

The passing of time was of great importance to the Mayas. To understand Mayan history, architecture, and agriculture, some knowledge of their calendrical computations is necessary. In the science of time and basic mathematics, the Mayas far outdistanced every other civilization of the ancient world. The study of astronomy and the pseudo-science of astrology contributed to Mayan mathematics and religion.

Correlation of Mayan and Gregorian calendric cycles has never been fully agreed upon. Two systems of correlation are currently in use: one devised by H. J. Spinden and the other by J. T. Goodman, Martinez Hernandez, and J. E. Thompson (known as the Goodman-Thompson correlation). The latter correlation has been most widely used, and it is the correlation used in this work. Should the reader desire to know the Spinden date, he need merely subtract 260 years from the date in question. It should be noted that radioactive carbon tests tend to favor the Spinden correlation.[2]

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[1]An excellent copy of the Dresden Codex can be seen in the Museum of Anthropology and History, Merida, Yucatan, Mexico.

[2]H. E. D. Pollock et al., "Mayapan Yucatan Mexico," p. 9.

The Gregorian calendar measures time from the birth of Christ. The starting date of the Mayan calendar is unknown. However, Spinden calculated from recorded dates and interprets the beginning as October 14, 3373 B.C. (3113 B.C. by Goodman-Thompson). This date is three thousand years before the earliest known recorded date and archeologists generally agree that it denotes a hypothetical rather than a historical starting date.

Over a period of many centuries by using towers, platforms, and fixed lines of sight, the Mayas recorded time based upon the equinox, the planet Venus, and lunar cycles. Tables were devised for the prediction of solar and lunar eclipses.

The Mayan calendar counted only elapsed time. We say the time is 3:30 p.m., using elapsed time (3-1/2 hours after noon). Our year is 1964, which is current time. The Mayas would refer to this as 1963 until midnight of December 31; and only then would they call it 1964 because the year would then be complete.

There were four measures of time in the Mayan system:

1. 365-day solar year consisting of 18 20-day months plus one 5-day month which was considered extremely unlucky.
2. 260-day ritual year consisting of 13 20-day months.
3. Lunar year which recorded dates as days after a new moon.
4. 584-day Venus year.

Each of these systems was used as a check upon the other and if an error appears in dating, it is easily detected.

Leap year was not used in connection with the solar year. The priests and astronomers were aware of this error and worked out corrections which were projected for many years. The solar calendar was used by the rulers to set dates for the annual preparation and planting of the fields.

The ritual or sacred year was used to record the birth date of individuals and the birth date governed the entire future of the individual through astrology and the horoscope. The 13-month positions are under various patron gods and their symbols (called glyphs) are used as basic numbers as well as to depict the specific gods.

The planet Venus was an object of great interest to the Mayas. They were aware that the revolution of Venus was slightly less than 584 days (583.92) and that five Venus years equalled eight solar years. To correct this error, four days were dropped at the end of every sixty-one Venus years. At the end of every three hundred years, eight days were dropped. Had this system been continued until the present day, the error would be less than one day. The accuracy of their observations, unaided by telescopes, points to centuries of continuous observation.

In Copan there is an altar sculptured in low relief depicting a congress of astronomers and priests which took place in this city in 503 A.D.

Arithmetic

Probably the most noteworthy innovation in Mayan

mathematical development was the concept of zero. This was developed during the five hundred years before the Christian Era.[1] At only one other place in antiquity was the zero independently evolved; the ancient Hindus developed it and passed it on to Arabia. The Moors acquired it from Arabia and introduced it into Europe during the Middle Ages. The Mayas were using the zero far earlier than the Hindus and about seven centuries before western Europe. The zero in Mayan inscriptions and hieroglyphic writings is represented as a stylized shell, an open hand, or by one of several glyphs.

The Mayan system of numbers is far simpler than the "Roman" system which used I, V, X, L, C, M, etc., in combinations which require addition and subtraction. The Mayan system uses only the dot (.), dash (-), and zero sign.[2] Numbers above nineteen were read according to their placement in vertical columns. In reading the column from the bottom up, each ascending position increases in multiples of twenty with the single exception of the third position from the bottom. This is increased eighteen times. Numbers placed opposite their specific position were multiplied by their corresponding number; the column was then added.

In reading a number from the bottom up, the first numerical order is multiplied by one (1), the second by twenty (20), the third by 360 (18 times the second order), and in all orders above

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[1]Charles Gallenkamp, "Maya, the Riddle and Rediscovery of a Lost Civilization," p. 102.

[2]See following page.

MAYAN NUMERATION

EXAMPLES OF HIGHER NUMBERS

• x 20 = 20

 x 1 = 0

20

x 20 = 300

 x 1 = 6

306

 x 360 = 1800

 x 20 = 160

x 1 = 4

1964

• x 7200 = 7200

 x 360 = 1080

x 20 = 200

x 1 = 5

8485

the third order, the unit progression is multiples of twenty.[1] In the following manner:

Sixth order multiplies 20 x fifth order, or 2,880,000

Fifth order multiplies 20 x fourth order, or 144,000

Fourth order multiplies 20 x third order, or 7,200

Third order multiplies 18 x second order, or 360

Second order multiplies by 20

First order multiplies by one (1).

This system corresponds to the solar calendar which used 18 20-day months. So 18 uinals (months) x 20 kins (days) equals one tun (360 days). In the same manner 20 tuns equals a katum (7,200 days), 20 katum equals one baktun (144,000 days), and 20 baktun equals one pictun (2,880,000 days).

Coupled with the simple dot, dash, and zero notation is an elaborate system of numbering by glyphs. The glyphs are human-like head figures (based on the gods of the ritual year) representing numbers from 1 to 13 plus zero. The skull and jaw represent various numerical values and when the skull of one value is used with the jaw of another numerical value, numbers from 14 to 19 are obtained.[2]

A date numbered 9.11.5.0.0. indicates the elapsed time of 9 baktuns, 11 katums, 5 tuns, no uinals (months), and no kins (days), a date equivalent to 675 A.D. Dates found on stelae and

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[1]George Kubler, "The Art and Architecture of Ancient America," p. 118.

[2]George Kubler, "The Art and Architecture of Ancient America," p. 118.

buildings are usually rounded off to 5-, 10-, and 20-year periods. In remote highland communities of Guatemala and southern Mexico, this system of time is still used for worship and ritual.

The study of Mayan numeration, astronomy, and calendars has fascinated and amazed many modern-day scholars.

THE CITY

When applied to the Classic Mayas, the term "city" is a misnomer. Cities were the religious centers and the centers of government. The common people lived in small settlements and villages scattered around the surrounding countryside. The only permanent population of the cities was restricted to priests and noblemen. The common people used the cities for religious purposes, courts of justice, and probably to attend markets.[1]

All Mayan cities have some similar characteristics, which consist of rectangular low mounds and flat-topped pyramids. Each city has a plan all of its own dictated by the regional pattern, period of development, and topography. The aboriginal city planners did not establish fixed patterns for architecture and city plans. The grandeur of their cities results from a combination of open spaces and a keen sense of architectural proportion.[2]

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[1]J. Eric S. Thompson, "The Civilization of the Mayas," p. 15.

[2]Paul Damaz, ("Art in Latin American Architecture"), from Craft Horizons, September/October, 1963, p. 24.

Tulum on the east coast of Quintana Roo and Mayapan in central Yucatan are the only walled cities in all Maya.[1] Tulum was occupied for a short time during the Classic period and reoccupied in about 1300 A.D. Excavations at Mayapan indicate this site was used from Pre-classic times until the fall of the city in 1450.[2] The visible ruins, however, are all Post-classic (Toltec). The absence of fortifications is further evidence that the Classic era was peaceful. Selection of hilltop sites for many of their cities was for aesthetic rather than defensive purposes.

The cities and architecture of the Mayan civilization can be classed under three very broad geographic areas:

1. The Motogua River valley at the base of the Yucatan Peninsula.
2. The Usumacinta River and its tributaries on the west.
3. The central region known as the Peten region.

The most important cities along the Motogua River are Copan and Quirigua, with Copan being the "Mother City". Along the Usumacinta River we find two cities where influence does not follow the geographic pattern. Piedras Negras, Bonampak, and Comalcalco belong to the tradition of Panelque, while Yaxchilan (west of the Usumacinta River) belongs to the Peten tradition. The Peten influence covers the entire central area and all of present-

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[1] Sol Tax and others, "The Civilizations of Ancient America," p. 104.

[2] H. E. D. Pollock and others, "Mayapan Yucatan Mexico," p. 264.

day Yucatan, British Honduras, Campeche, and Quintana Roo. Within the Peten tradition are three distinct regional patterns in which provincial detailing can be detected. However, the general pattern closely resembles the Peten tradition.[1] The southern tip of Yucatan, most of central Campeche, and southwestern Quintana Roo follow what is called the Chenes pattern. The low hills country of Yucatan is known as the Puuc. The true Peten style surrounds Lake Peten, all of northern Guatemala, and extends to Rio Bec.

It is generally agreed that the Palenque tradition is the newest of the Mayan traditions. Most authorities agree that Uaxactun, (Peten district), is older than Copan. The oldest dated stela found at Uaxactun is dated 328 A.D., while the oldest stela at Copan is dated 465 A.D. There is abundant evidence that both cities were occupied long before the Christian era, perhaps as early as 3000 B.C. Until 1956, when excavations were begun at Dzibilchaltun in northern Yucatan, it was thought that the Puuc region was of a much later period than the Peten area. It now appears that Dzibilchaltun dates to the pre-Christian era and was occupied until the time of the Spanish conquest.[2] In fact, the site of the city is still occupied by sisal growers living within the ruins.

The land area of the cities varies greatly. Dzibilchaltun

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[1]George Kubler, "The Art and Architecture of Ancient America," p. 143.

[2]E. Wyllys Andrews, "Excavations at Dzibilchaltun, Yucatan, 1956-1962," p. 3.

is some 2-1/2 miles wide and 7-1/2 miles long; Chichen Itza covers an area roughly 1-1/2 by 2 miles; Palenque 300 yards by 500 yards (though evidence of numerous buildings indicates the site may have been some 3-1/2 miles long at one time); Uxmal 1/2 by 3/4 mile; and Mayapan approximately 3/4 mile by 1-1/2 miles.[1] The Instituto Nacional De Antropologia E Historia of Mexico has some 600 ancient Mayan cities accurately located. Of these, perhaps 100 were ceremonial centers and the remainder were centers of lesser importance.

Uaxactun is the oldest city in the Peten district and was probably the Capital city.[2] It was occupied from the very Early Development period until the end of the Classic period. This in itself would account for the vast complex of groups, each located on the summit of a hill with the main group on the summit of two hills. These hills were flattened and connected with a raised causeway or plaza. This group is usually referred to as the "great acropolis". The buildings of the two groups within the acropolis are grouped around open courts and plazas with a causeway to extend the space of the plazas. The appearance is orderly, even though the buildings are not oriented at right angles to one another. The entire complex of Uaxactun, however,

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[1]Sizes of the sites taken from official guidebooks published by The Instituto Nacional De Antropologia E Historia and Carnegie Institution reports.

[2]Thomas Gann and J. Eric S. Thompson, "The History of the Maya," p. 29.

does not have the overall appearance of order that exists in the acropolis.[1]

To the west of the acropolis is a stone-faced pyramid some 50 feet high in front of which is a stela, and on the opposite side of the central court is a truncated pyramid with three temples in a row upon the summit. It is believed that this group is an astronomical observatory since a line of sight between the three temples and stela is in alignment with the spring and autumn equinoxes.

Tikal, a colony of Uaxactun, is located just 15 miles to the southwest of Uaxactun. The earliest recorded date is 445 A.D. and the city was occupied for at least 425 years. The buildings here are finer, more impressive, and, due to greater wall thickness, are in a better state of preservation. This city is much more orderly than Uaxactun and shows overall planning which is not apparent at Uaxactun. This clearly indicates that by the time Tikal was established, city planning had become an important part of the Mayan culture.

Tikal has nine groups of buildings and five main temples.[2] The temples are all located upon lofty pyramids. They are approached by steep stairways and are surmounted by high roof combs. The tallest structure at Tikal, Temple V, is 230 feet tall.

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[1]Excellent maps of the city are found in A. Ledyard Smith's "Uaxactun, Guatemala: Excavations of 1931-1937," in map pocket at back of book.

[2]See Plate II, p. 53.

All groups at Tikal are connected by causeways and ramps which serve to extend the orderly space of the plazas and to create unity among the various groups.

So far as is known, only one ball court has been identified in the Peten area and that one is at Tikal.[1] Here the ball court is not a predominant feature of the city as it is in the river towns. It is possible that the Peten tradition had settled upon architectural features before the invention or spread of the ballgames.

Copan is the southernmost city of the Mayan civilization and is located in a small valley formed by the Copan River which is a tributary of the Motagua River.[2] It is surrounded by mountains rising about 900 feet above the valley floor. From artifacts found in this area (which belong to the pre-ceramic phase), it is assumed that the valley was inhabited about 3000 B.C.

There is no doubt that the residents of Copan were advanced in the sciences and arts. It is here that the first congress of astronomers and priests was held. And since Copan has so many beautifully carved altars, stelae, and a spectacular hieroglyphic stairway, it became the city most frequently used to decipher and classify the Mayan calendric system.

The roof combs which are so important to Tikal and used throughout Maya, are absent in Copan. The intricate details were applied to door jambs and trim around the doors.

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[1]Ball courts are found at sites in the Chenes and Puuc.

[2]See Plate III, p. 55.

Copan is an assembly of open volumes rather than a collection of buildings. The plazas are large spacious concourses, studded with the most exquisitely sculptured altars and stelae to be found in all Maya. They are situated on many levels and terraces and commemorate the passage of 5-, 10-, and 20-year units of the Mayan calendar.

Copan is situated on an artificial hill not only to mark its importance, but also to form a main court at its base. The stairway from the main court up to the acropolis is over 300 feet wide. This stairway defines the south border of the main court and acts as a back drop to the ball court, giving it a theatrical setting. If the steps were intended for spectator seating, they could seat 50,000 people.[1]

There is a variability in the size, form, and setting of ball courts.[2] The one at Copan is an important architectural feature. The game was played with a rubber ball with the object being to drive the ball through a ring placed high on each wall, halfway between the opposing sides. Hands were not allowed to touch the ball. The ball was maneuvered with hips or knees. The game was in some way bound up with their religion. At the time of the Spanish conquest it was the most important game in Yucatan.

An underground drainage system carries the rain water drained from the structures and ball court to the Copan River.

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[1]Jesus N.Chinchilla, "Copan Ruins," p. 26.

[2]J. Eric S. Thompson, "The Civilization of the Mayas," p.74.

The Construction system used in this drainage system is of a much later date than the buildings on the acropolis.

Undoubtedly the river added a great deal to the setting of the city. The acropolis is more than 100 feet above the river and drops abruptly to the channel. The river also washed away a part of the east side of the acropolis and one can assume that a grand stairway once formed the west bank.

On two hills, one due west and the other due east of Copan, are two stone monuments. One is dated 589 A.D.; the other includes this date along with two other dates. These stones are believed to form a gigantic sundial more than four miles across. Like the stela-temple group at Uaxactun, these monuments are in line with the spring and fall equinoxes.

Palenque is located west of the Usumacinta River, in present-day Chiapas, about 200 miles west of Uaxactun.[1] It was the center of the arts of the Classic period and one of the westernmost cities of the Mayan area. It reached its height during the sixth and seventh centuries, though it was occupied from about 500 to 900 A.D. Judging by the size of the city and the surrounding area, it is possible that Palenque had a population of 100,000 at its peak.

The most outstanding feature of Palenque is a small river, the Otolum, that runs through the city. A corbel-vaulted underground aqueduct allowed the city to build over the stream. In Classic times the courtyard and plazas on each side of the stream

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[1]See Plate IV, p. 57.

were not interrupted by the Otolum.

A chief characteristic of Palenque is the spaciousness of the city as well as the interior space of the buildings. Open space and the feeling of space must have been a keen desire of the planners. The palaces and pyramids were placed further apart than in the Peten area and at Copan.

Within the large courtyards, it is difficult to identify the function of the various platforms and buildings. Probably the objective of Palenque planners was to achieve variation by space, height, and various levels of the terraces. Such open volumes and height changes create a striking formal environment which is in sharp contrast to Uaxactun.

ARCHITECTURE

The architecture of Maya can be placed into four chronological classifications:[1]

1. Early Development (Pre-masonry) - up to 500 B.C.
2. Late Development (Pre-vault) - 500 B.C. to 300 A.D.
3. Early Classic (Vault I) - 300 A.D. to 600 A.D.
4. Late Classic (Vault II) - 600 A.D. to 900 A.D.

The geogrsphical location of the various sites will cause slight variations in this classification. Vault I and II refer to refinement of construction and building detail rather than

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[1] A. Ledyard Smith, "Uaxactun, Guatemala: Excavation of 1931-1937," p. 67.

one and two rows of vaults.

Early Development period buildings consisted of posts and thatch. Four or more posts were sunk into the ground. A wood roof system and side wall frame were attached to the main posts and the entire frame covered with twigs or thatch. The houses in the villages and interior of the Yucatan Peninsula still follow this time-honored method of construction.

During the Late Development period the same general method of construction was used. The side walls were stuccoed on the better class houses and religious buildings. In these buildings is found the earliest known Mayan masonry. The floor was built upon a low masonry platform, one course high, which was plastered to give it a smooth finish. The building superstructure was perishable, but remains of these house mounds have been excavated.

During this period the first truncated pyramids were erected. The core material consisted of earth, rubble, and general fill material. The outer core was covered with large cut stones with header courses tailed into the fill. The entire surface was then stuccoed.

The Early Classic period (Vault I) used the same general construction but the core material was improved. Temples with masonry walls placed on top of pyramids required a better foundation. Lime mortar was added to the stone rubble to strengthen the core. During the final years of this period, the quality of workmanship of the facing stones was not as carefully executed and spalls were used liberally.

At the end of the Vault I phase and the beginning of Vault II period, there is a marked transitional stage where the facing stones become smaller. Some are laid with headers into the core and some as veneer only. Following this mixed period, the facing stone was laid vertically against the core. The facing stones were slightly rounded on the back side, providing more surface to be bonded to the core.[1]

Walls carrying masonry vaults had to be much thicker than walls carrying beam and mortar roofs. Throughout the Puuc, the core of the walls became a better quality concrete while in Palenque the stone walls were laid up with larger stones completely overlapping each other, leaving no room for mortar fill. In Palenque the facing was an integral part of the wall construction.

In general, the line of development was from block masonry to a concrete core with stone veneer, from massive walls with narrow chambers and small doors to wider chambers intricately connected to form combinations of rooms with piers and columns which let in more light than the small doors would allow. Window openings were not common and the relatively few windows were very small. At Palenque some "T" shaped openings pierce the outside walls about 4'-6" above the floor.

Limestone was the most common building material except in Comalcalco, State of Tobasco, where limestone is not available. Very early in their development, the Mayas had discovered the

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[1]See Plate VII, Fig. 1, p. 63.

secret of burning limestone to obtain lime which they could use for plaster, stucco, mortar, and later for concrete. Lime marl, the loosely-formed lime material directly under limestone ledges, was excavated and dried or burned to obtain lime for their building mortar, plaster, etc.[1]

In Comalcalco bricks were made of local clay and fired in open kilns and mortar was derived from burnt oyster shells. The usual brick is about 2" thick, 10" long, and 7-1/2" wide. One lintel in Comalcalco of fired clay is 40" long. The mortar joints vary from 1-1/2" to 3" in thickness, which is in some cases greater than the thickness of the bricks themselves. Comalcalco belonged to the Palenque tradition and all buildings were covered with a thick layer of stucco.

Massiveness, strength, and monumental scale are the chief characteristics of Classic Mayan architecture. The arch was totally unknown. Corbels were used to simulate arch forms and because of this, rooms seldom exceed twelve feet in width. Chambers of ten-foot width and less are far more common. In all masonry buildings there is considerably more cubic feet of building material than open chamber space.[2] Construction techniques of walls and vaults vary greatly with the period of development and the regional pattern. In addition to this, sites

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[1]This practice is still being followed throughout rural Yucatan.

[2]The Governor's Palace at Uxmal contains 200,000 cubic feet of stone and a chamber space of 100,000 cubic feet. If the substructure is added, the masonry occupies 40 times more volume than the chamber.

relatively close together, built within the same zone and at approximately the same time, have distinct differences. At Labna and Sayil rounded vaults are used while at Uxmal and Kabah the late classic vaults are sloped inwardly at an even slant.[1] These sites are all within 30 miles of each other.

The Mayas evidently lacked faith in stone for lintels and used wood almost universally for tie beam reinforcements for their vaults and for lintels. Sometimes wood beams were laid and completely covered with masonry to create flat ceilings. So far as is known, only three vaults exist where stone was used for the vault ties and all of these are in Palenque.[2] The underground aqueduct (culvert) as well as the tomb and stairway ceiling within the Temple of Inscriptions also have stone ties.

By far the most common method of building a corbelled vault was to project the first stone above the spring line inwardly. These projections vary from 1/2" to as much as 5" and from this point each ascending course of stone slopes inwardly to a point just below the ceiling cap stone.[3] At Palenque, however, belt courses just below the spring line are common.[4] The

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[1]See Plate VIII, p. 65.

[2]C. L. Hay and others, "The Maya and Their Neighbors," p. 207, and numerous other books list the underground aqueduct at Palenque as the only vault using stone ties. Ruz Tomb was first entered in 1952, so anything published before this date can list only one example.

[3]One popular theory for this method of building vaults is that the projection enabled removal of wooden forms used in constructing the vault.

[4]See Plate V, Fig. 2, p. 59.

surfaces of some vaults were plastered to give a more uniform surface. At Palenque some vaults contain deep coffers which break the monotony of the uniform surface and may well have been intended to hold sculpture.[1]

Palaces sometimes containing numerous rooms were built upon the mounds, while temples having only one to four rooms were erected on top of the pyramids. These smaller structures were probably dedicated to various gods and served religious roles. The large buildings were used for religious purposes, courts of justice, storage of religious paraphernalia, and probably for housing of priests during certain times of the year.

The term "nunnery" is attached to certain groups of buildings, usually where the group forms a quadrangle. This is obviously a misnomer since woman's role was that of mother and housewife. No one can be certain what the real purpose of the nunnery was, but it could possibly have served as a training place for the children of the nobility, priests, astrologers, architects, etc.

Certain buildings have been identified as steam baths, or sweat houses. Some elaborate stone buildings were erected for this purpose and were probably used for medicinal purposes or a ritual of purification. The limited number of the elaborate steam baths would indicate their use was restricted to a very limited number of people.

The exterior design of buildings received far more

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[1]See Plate IX, Fig. 3, p. 67.

consideration than the interiors. Probably no civilization ever created such showy architecture with such cramped, and generally unadorned interiors. Mayan architectural symmetry was never rigorous, even though masses are distributed in apparent balance. When measured exactly, the angles are rarely true, room widths vary, and apparent right angles invariably add or lack a few degrees. The visual effect is regular and was achieved without close calculations.

Heavy stone piers of the southern area facades gave way to round and square columns to vary the rhythm of the openings and improve the lighting within the chambers. Stucco exteriors gave way to geometric designs of carved stone and were assembled like mosaics in the vault zone of the facades.

The essential parts of exterior elevations are the wall area up to the spring line of the interior vaults (the bearing wall) and the area above the spring line (the vault zone). Throughout the Peten, including the Chenes and Puuc, the ratio between bearing wall and vault zone is about 1:1, although Late Classic buildings give slight favor to the vault zone in a proportion of about 5:4.[1] The exterior walls were kept essentially as one plane from ground to roof except in the Palenque and Copan districts where the facades show a mansard-like roof line.

During the Early Classic period, doors were spaced toward the center of rooms and uniformly spaced along the facade with

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[1]See Plate XVI, p. 81.

no attempt to accent any door. The Governor's Palace and all buildings in the Nunnery at Uxmal, except the north building, have variable spacing. At Palenque, however, one finds the widest openings in the center and toward the corners of buildings the openings tend to diminish in width. At Sayil and Labna the uniformity is broken by double and triple width openings with columns spaced within the opening.[1]

The Nunnery Quadrangle at Uxmal suggests that the Mayas may have deliberately tried to achieve visual correction. The north and south buildings are visually parallel, while the east and west buildings converge toward the north building. Their facades have a pronounced outward lean which suggests a perspective correction similar in plan to Michelangelo's Campodiglio in Rome. Standing in the center of the north facade and looking south across the quadrangle court, the Governor's Palace is framed by the Nunnery's main entrance arch. The south building has two striking features: the variable spacing of entrance doors and the archway entrance, which is on an axis with the ball court.

In addition to the arched entrance to the Nunnery at Uxmal, two other great arches are located nearby. One is at Kabah and the other at Labna. The arch at Labna is by far the most famous. Illustrations generally show only its east face which does not indicate the elaborateness of the west facade.[2] Going through

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[1]See Plate X, Fig. 1, p. 69.

[2]See Plate XV, Fig. 3, p. 79.

the arch from east to west one enters a court yard bounded on four sides by ruins of what was once the Nunnery, though much smaller than the one at Uxmal. The west facade of the arch has two small doors on each side of the passage leading to small vaulted chambers and was obviously the most important facade in Classic times.

The arch at Kabah was the entrance to the city. This arch marked the beginning, or terminus, of a wide built-up stone road (sacbe) which connected Kabah and Uxmal, nearly 15 miles apart.

The Governor's Palace at Uxmal is the longest and certainly one of the most refined Mayan buildings. The facade has a proportion favoring the vault zone over the side wall in the ratio of about 5:4. The frieze, which covers the entire area of the vault zone, has an overall continuity with a focal point directly over the main (central) entrance. Actually the Palace was made up of three buildings. The center building consisted of a double row of vaults with two long central chambers and was flanked by four smaller rooms on each side. The two smaller structures, containing five rooms each, were connected to the main building with two great arched passages.[1] At some later date these passages were closed to form chambers. This complex group was unified by the continuous frieze bands and geometric stone mosaics into one of the greatest pieces of Pre-Columbian Architecture. The Palace is 320' long and rests upon a terrace

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[1]See Plate XII, Fig. 1, p. 73.

which is 400' long, 90' wide and 23' above a very broad terrace some 600' long, 500' wide and 40' high.

Just 2-1/2 kilometers south of Chichen Itza, in an area known as Old Chichen, is a building known as The Temple of Three Lintels. This building is of the Classic Mayan period, with characteristic Puuc detailing and facade proportions of 1:1.[1] Unlike so many of the Classic structures, the lintels here are of stone and are intricately engraved with glyph figures far finer in quality than those found in Toltec-Mayan Chichen Itza. The building is only one room wide and is broken into three rooms of approximately equal length.

On top of the roof an ornamental wall called a roof comb or flying facade was frequently added to Classic temples and palaces. The roof comb could be either a solid or pierced wall and its primary purpose was to add height, decoration, and mark the importance of the building.[2] Roof combs were sometimes placed directly above the front or rear wall, sometimes over the capstones of the vault, and occasionally over the center bearing wall. A seemingly popular theory that the roof comb was primarily intended to stabilize the corbeled vaults is questionable since there was no uniformity in their placement.

The high roof comb, when added to the high side walls, gave the Mayas a very large surface for decoration and they took full

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[1]See Plate XVI, Fig. 1, p. 81.

[2]Sylvanus G. Morley, "Guide Book to the Ruins of Quirigua," p. 129.

advantage of this.[1] Virtually all the exterior surface was covered with geometric designs. Decoration in the Puuc is much more prolific than in the area closer to Lake Peten, and the designs are mostly stylized symbols. Conventionalized masks of the long-nosed rain god "Chac", serpents, and symbols of fertility were most frequently employed. Details of the stylized masks of Chac vary not only with the tradition of the area, but from one building to another within a given city. Eyes, ears, mouth, and noses have the same general overall appearance, but closer examination shows these details are not consistent.[2] At Kabah the front facade of the Temple of Masks had at least 252 masks dedicated to Chac.[3]

The rattlesnake, universal Mayan symbol of fertility, was stylized and interwoven to the frieze or vault zone forming an almost continuous fret. The main facade of the Governor's Palace at Uxmal has a huge fret symbolizing a serpent plus another serpent which is wound about the uppermost frieze or coping.[4] Into the overall fret designs, other symbols depicting various deities, lattice work, or simple geometric forms were employed as background for the main treatment.

Classic details frequently employed pictorial representation of pole and thatch construction. Vertical poles are depicted on numerous masonry buildings with corners of the

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[1]See Plate XI, p. 71.

[2]See Plate XIX, Figs. 3, 4, and 5, p. 87.

[3]See Plate X, Fig. 2, p. 69.

[4]See Plate XIX, Fig. 7, p. 87.

buildings clearly showing a heavier post.[1] The west facade of the arch at Labna shows thatch dormer roofs over the two niches on either side of the arch.[2]

The "X"-shaped lattice work which appears at so many sites was representative of basket weaving. Basket weave lattice was achieved in two different ways: one was three-dimensional relief carved into a square surface and the second type was three-dimensional and carved in the round.

Zig-zag mouldings within the vault zones are representative of corn (maize). The individual ears are cut and fitted into continuous bands.

Art and religion cannot be separated from Mayan architecture and their architecture was an expression of their culture.

There were few buildings in all Maya that exceeded three stories. To carry the extra load superimposed by upper stories, the wall thicknesses on the ground floor of multi-floored buildings were increased to a point where they practically closed the rooms. In some cases the ground floor was a solid mass to carry the second floor, giving only the appearance of a two-storied building. The Palace at Sayil is an exception. In fact the wall thickness in the Palace at Sayil actually increases from 25" on the second story to 37" on the third story.

The four-story tower at Palenque has its first story completely filled; however, an inside stairway leads from the second

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[1]See Plate XVI, Fig. 2, p. 81.

[2]See Plate XV, Fig. 3, p. 79.

to the fourth floor.

Inside stairways are rare. At Uaxactun only three inside stairways have been found, and at most other cities no inside stairways were built. At the Palace at Sayil outside stairways lead from one level to another.

The Caracol (observatory) at Chichen Itza is so named because of a circular stairway in the interior. "Caracol" in Spanish means "snail" and in Mexico a spiral stairway is referred to as a "snail stairway".[1] This stairway begins some five feet above the floor and makes a 270-degree turn as it rises up to the observatory floor. Head room is nonexistent and it is necessary to negotiate this stairway in a crawling position. The chief characteristic of Mayan stairways, interior as well as exterior, is that the risers are invariably of greater dimension than the tread.

The Palace at Palenque has four interior stairways: one in the tower and three others leading from the Palace to subterranean chambers. The most unique stairway at Palenque is the stairway in the Temple of Inscriptions. This stairway originates within the temple some 75 feet above the ground level and continues down through one landing to the Ruz Tomb 80 feet below the temple floor.[2]

The Temple of Inscriptions is a most important building; it contains the longest known series of Mayan hieroglyphics and is

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[1]Jorge G. Lacroix and others, "Chichen Itza," p. 33.

[2]See Plate XIV, Fig. 1, p. 77.

the only temple containing a burial chamber. In contrast to the usual practice of plastered floors, this floor is of stone slabs and shows no sign of ever having been covered with plaster. Close examination of the floor shows evidence of inscriptions being incised into the floor.[1] While cleaning the central chamber, one floor slab was found with three plugged holes at each end. Apparently no one had noticed also that the walls were outside the floor line and continued downward.

In 1949 Alberto Ruz was studying this particular temple and removed this stone slab. When it was lifted and some rubble removed, the outline of a stairway appeared. During the next four seasons (two to three working months each), the rubble was slowly removed from this stairway with no idea of what would eventually be discovered. On June 15, 1952, a large triangular door slab was removed and the tomb was viewed for the first time since being sealed thirteen centuries ago.[2]

The burial chamber is a room about 10' wide, 30' long, with a ceiling 22' high. On the floor was a richly carved stone slab 7' x 12' and 1' thick.[3] This slab was lifted and a crypt directly below contained the remains of a man, evidently of high rank, and one for whom the temple was built.

There was no gold in the crypt. The buried man had a jade

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[1]See Plate XIII, Fig. 4, p. 75.

[2]Charles Gallenkamp, "Maya, The Riddle and Rediscovery of a Lost Civilization," p. 128. Also an interview with Mr. Ruz at Palenque, Chiapas, Mexico, February 26, 1964.

[3]See Plate XIV, Fig. 3, p. 77.

ornament in each hand and one in his mouth; his shoulders and neck were covered with a huge collar and a breast ornament of jade beads. His face was covered with what is the now famous "Palenque Mask" made of jade mossic. (This mask is now in a museum in Mexico City.)

The three stone tablets in the Temple of Inscriptions, one centered on the wall of the center chamber and the other two flanking the door to the center chamber, contain 620 hieroglyphics.[1] They cover a series of dates embracing a period of 200 years. The date which corresponds to this temple is the year 692 A.D.

Mayan pyramids were built to form the base and to elevate important temples. Classic pyramids were constructed of earth, rubble, large stones, and were faced with stone and usually covered with stucco. During Late Classic times stucco was omitted and belt courses or simple geometric designs served as surface decoration. Earlier pyramids usually had four stairways, one on each of its four sides, leading from grade to the temple at the summit. However, in some areas one stairway was preferred. Hieroglyphics were sometimes carved into the risers. Other stairways were plain and a few important entrance stairways had hieroglyphics carved into stone tablets on either side.

During the Classic period many pyramids and temples of earlier periods were completely covered by a new enlarged structure. The old became the core of the new. The Temple of the

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[1]Alberto Ruz, "Palenque," p. 34.

Seven Dolls at Dzibilchaltun was one of those completely covered by a newer pyramid which was removed to expose this temple.[1] The Castillo at Chichen Itza and the Pyramid of the Magician at Uxmal both contain earlier temples. At both sites, partial excavations allow viewing of the earlier temples.

All Mayan pyramids are truncated. However, the number of truncations varies as does the overall design. The corners were rounded and on earlier pyramids the corners were recessed, creating a more complex pattern.[2] When viewed from the top, the corners are surprisingly irregular.

The stairways on all pyramids were wide and steep; the angles vary from approximately 45 degrees to an angle of 60 degrees.[3] Illustrations showing the priests wearing long robes, huge headpieces, etc., makes one wonder how they could have ascended these stairways gracefully.

Residential areas of the common people were grouped about the periphery of the cities. At Uaxactun some house mounds are located between various groups within the city. The first

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[1]See Plate VI, Fig. 2, p. 61.

[2]The Castillo at Chichen Itza, Temple of Inscriptions at Palenque, and Temple at Mayapan use nine equal truncations. The Temple at Labna and The Temple of the Magician at Uxmal were truncated, but heights of the truncations vary (see Plate XVII).

[3]The Castillo at Chichen Itza has 91 risers of about 10-1/2" with treads of about 10-1/2". The west stairway at the Pyramid of the Magician, Uxmal, has 54 12-inch risers with 7" treads, while the east stairway has 89 12-inch risers leading to a higher temple. The Temple of Inscriptions at Palenque has 72 risers averaging 12-1/2" with 9" treads.

Spanish to arrive in Yucatan recorded in their diaries the fact that they passed through towns of 1000 to 5000 houses.[1] At Uaxactun excavations reveal a maximum population of 1000 persons per square mile in an area of 314 square miles. From these excavations it is possible to establish the probable number of houses in a given area; however, it is generally agreed that all houses were not occupied at the same time.[2]

Studies and excavations of Classic Mayan housing are limited to the remains of house mounds which indicate that the construction system closely resembles that of present-day houses of the Yucatan Peninsula. Undoubtedly all of the dwellings of the Classic era were not built upon masonry platforms, so a complete study of street layouts and overall planning of housing areas has not been possible.

Graves are sometimes found under the floors of house mounds. When the inhabitants of a house died, they were sometimes buried beneath the floor. After several burials the house was abandoned and was then treated as a burial plot.[3] Members of the nobility were buried in cemeteries such as those found in Uxmal, Palenque, Kabah, Uaxactun, and many other cities.

Classic house plans favored square end walls, while present-day houses favor a rounded end wall. The simplest type house

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[1]S. K. Lothrop, "Tulum: An Archeological Study of the East Coast of Yucatan," p. 17.

[2]Oliver G. Ricketson, Jr. and Edith Bayles Ricketson, "Uaxactun, Guatemala. Group E," p. 16.

[3]Victor W. VonHagen, "World of the Maya," p. 53.

had only one room with walls of vertical saplings lashed together.[1] A better class house would be of the same type construction, but would have a small kitchen built a few feet away from the house. The finest houses were essentially the same except that the walls were stuccoed or made of stone.

Some of the houses that have been excavated and studied were a great deal more complex. Some of these had a number of rooms and were probably houses of the nobility.[2]

Close examination of the thatched houses shows that the exterior wall is always a curtain wall and not a bearing wall. The roof frame is built upon four posts which are sunk into the ground and the exterior wall is placed outside the main posts. Two cross beams are lashed to the main posts and longitudinal poles are attached to the ends of the cross beams. Upon this system, an "A" frame was constructed to support the purlins and thatch.

Grass was preferable to palm leaves for thatching because it lasted longer. Estimates of expected life of these materials vary from twelve to thirty years for grass and six to fifteen years for palm leaves.[3] Fireplaces with chimneys were not used. One or two small fires were used within the house for cooking and the smoke filtered out through the roof. The smoke from

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[1]See Plate XVIII, p. 85.

[2]H. E. D. Pollock, "Mayapan Yucatan Mexico," Fig. 6a.

[3]Robert Wauchope, "Modern Maya Houses," p. 116.

these fires lodged in the thatch and protected it from insects and rodents.

The hearth was the center of home activity. It was located in a corner or along one end wall (or in the kitchen if this were a separate building). Two hearths, each consisting of three round stones, were used because different temperatures were necessary for cooking different things, such as tortillas and stew. The opposite end of the house was used for sleeping and may or may not have had a screen or partition separating it from the kitchen end.

Just what the refuse disposal system of Maya was is unknown, but there must have been a system, especially for the larger centers. A few refuse dumps have been found near dwellings, but these in most cases would not solve the problem. Today in villages of the Yucatan Peninsula, people depend upon the buzzards, dogs, and pigs to dispose of all refuse. Possibly this was true in ancient times. They certainly had buzzards and dogs and could easily have tamed the wild peccary.[1]

Characteristics of Mayan architecture cannot be classified in a set pattern of various orders. Regional patterns and individual building designs within specific zones clearly indicate that design was not fixed by some central power. Symbolism and glyph figures were almost universal, but even here regional differences are apparent. Major similarities in building stem from the use of the corbeled arch which created restrictions in

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[1]H. E. D. Pollock, "Mayapan Yucatan Mexico," p. 224.

building design. Even with this restriction, the Mayas showed amazing ability to adopt this construction method to suit their own desires.

Their great temples and palaces were obviously built to be enjoyed or worshipped primarily from the exterior. The interiors, lacking windows and often cross ventilation, were dark and damp.

Occasionally murals are found in some of the temples, with the murals at Bonampak being the most famous. Even in the very few Classic buildings where this type decoration is found, the interior walls could not have been properly seen with the relatively poor light and restricted vantage points from which to view them.

The one positive statement which can be made about Mayan architecture is that it lacked the true arch form. Other than this, only generalized statements can be made pertaining to the major characteristics of this architecture.

These characteristics are:

1. Massiveness and monumental scale
2. Entire exterior facades literally covered by decoration
3. Volume of building material greater than open chamber space
4. Stairways with risers of greater dimension than treads
5. Art forms as an intricate part of the buildings.

The Mayas were master stone masons and when one considers that their work was executed without the aid of metal cutting tools, it is truly amazing.

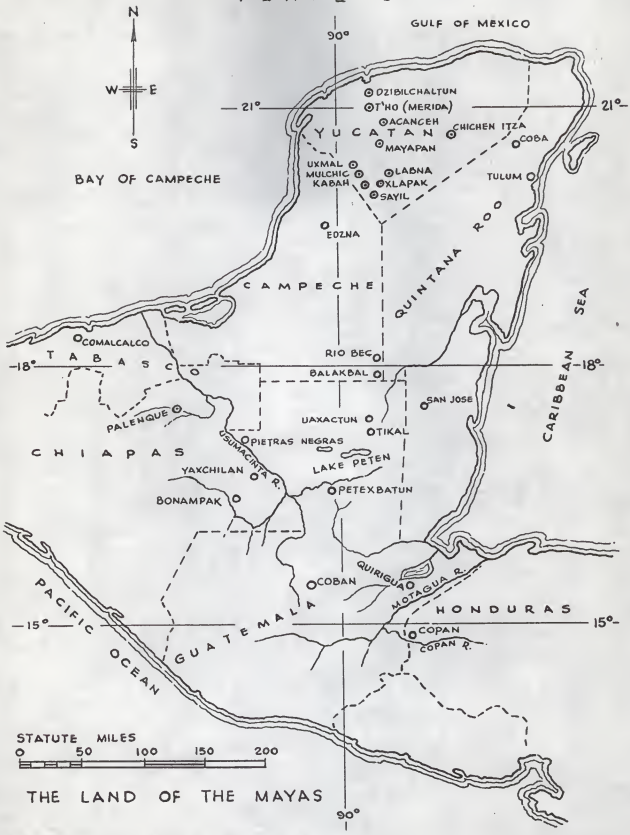
KEY TO PRONUNCIATION

Acanceh	Á'w-ken-kay
Cenote	See-nó-tee
Chac	Chawk
Chenes	Chén-eez
Chichen Itza	Chée-chen Eét-zah
Chultune	Chówl-toom
Coban	Ko-bahn
Copan	Ko-pahn
Dzibilchaltun	Zeb-béel-chowl-toon
Kobah	Ka-bah
Mani	Maw-nee
Maya	Maw-ya
Mayapan	My-ah-pon
Motagua	Mo-tah-qwa
Mulchic	Mool-chic
Palenque	Pah-lén-kee
Peten	Péh-ten
Piedras Negras	Pee-yéh-dras Néh-gras
Puuc	Pook
Quintana Roo	Kin-tá-na Roe
Quirigua	Keer-ée-gwa
Sacbe	Sawk-bee
Sayil	Sy-yeel
T'ho	Ta-hó
Tikal	Tee-kahl
Tulum	Too-lóom
Uaxactun	Wah-shock-toon
Usumacinta	Oo-soo-ma-séen-tah
Uxmal	Oosh-mahl
Xlapak	Shla-pawk

PLATE I. Map of Classic Mayа

Only major sites are shown. Dotted lines indicate present-day countries and states. Sites marked with dot within the circle were visited by this author during February, 1964.

PLATE I



THE LAND OF THE MAYAS

PLATE II. Plan of the City of Tikal (c. 600 A.D.).

PLATE II

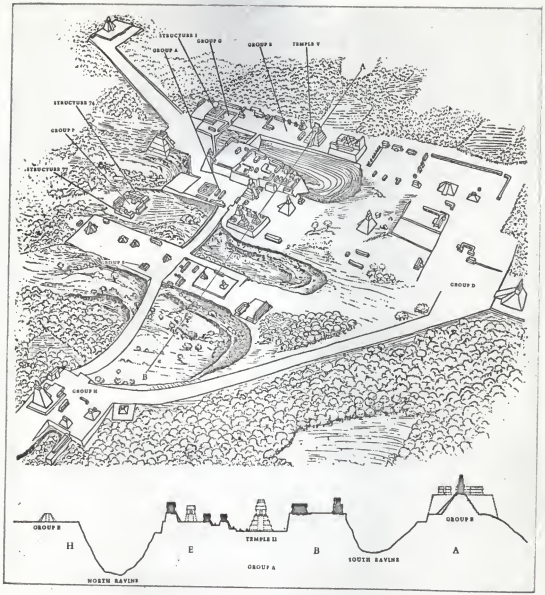

STRUCTURE I
GROUP C
GROUP B
TEMPLE V
GROUP A
STRUCTURE 74
GROUP F
STRUCTURE 77
GROUP E
GROUP D
GROUP H
B
GROUP B
H
E
TEMPLE II
B
SOUTH RAVINE
A
GROUP B
NORTH RAVINE
GROUP A

PLATE III. Plan of the City of Copan (c. 600 A.D.).
Southern half of plan represents the acropolis.

PLATE III

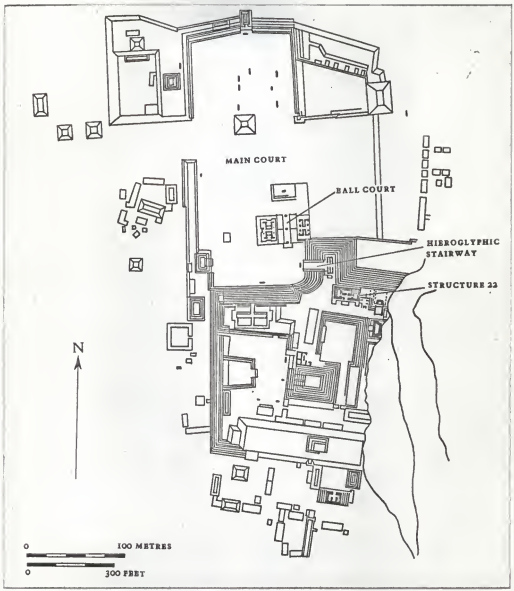

MAIN COURT
BALL COURT
HIEROGLYPHIC STAIRWAY
STRUCTURE 22
N
0
100 METRES
0
300 FEET

PLATE IV. Plan of the City of Palenque.

Seventh century.

PLATE IV

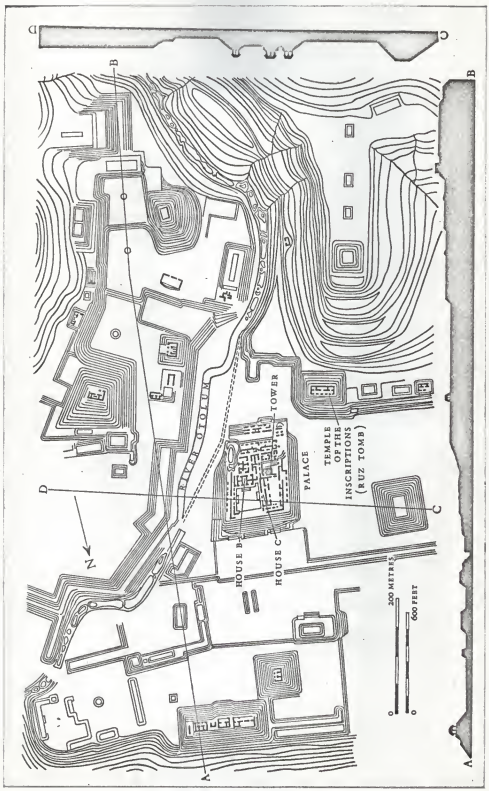

C
C
B
B
A
A
D
D
N
HOUSE B
HOUSE C
TOWER
PALACE
TEMPLE OF THE INSCRIPTIONS (KUZ TOMB)
200 METRES
0
600 FEET
0

PLATE V. Cross Sections through Corbel Vaults.

Fig. 1. Underground aqueduct (culvert) at Palenque.
Fig. 2. Chamber within the Palance at Palenque showing double step at spring line and plastered surface to center line.
Fig. 3. Chamber in south building, The Nunnery at Uxmal. (Notice shape of vault stones.)
Fig. 4. Small temple at Dzibilchaltun.

PLATE V

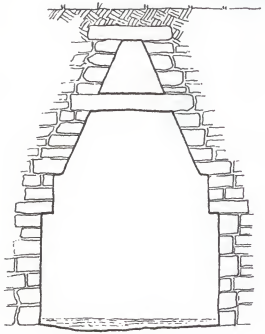


FIG. 1

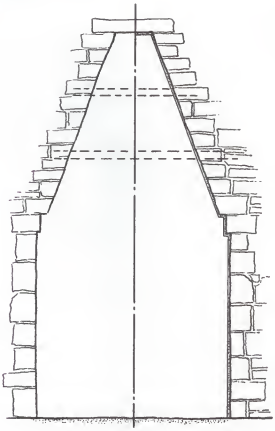


FIG. 2

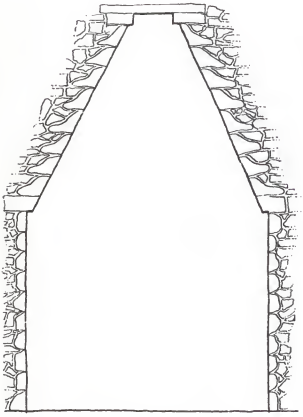


FIG. 3

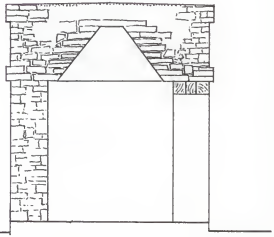


FIG. 4

SCALE IN FEET 0 2 4 6

PLATE VI. Temple of Seven Dolls and Labna Vault.

Fig. 1. Interior of Temple of Seven Dolls, Dzibilchantun.
Fig. 2. Exterior of Temple of Seven Dolls, (c. 483 A.D.).
Fig. 3. Cross section through temple vault at Labna.
Fig. 4. Photograph of vault shown in Fig. 3.

PLATE VI

FIG. 1

FIG. 2

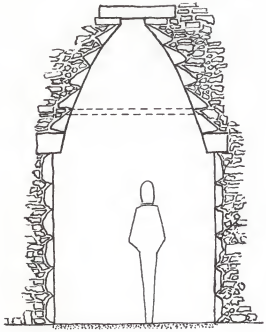


FIG. 3

FIG. 4

PLATE VII. Photographs of Vault Types.

Fig. 1. House of the Turtles, Uxmal (c. 800 A.D.).
Fig. 2. Palace Vault, Labna (c. 600 A.D.).
Fig. 3. Bath at Chichen Itza (Toltec-Mayan).

PLATE VII

FIG. 1

FIG. 2

FIG. 3

PLATE VIII. Interior Views of Vaulted Chambers.

Fig. 1. Palace at Labna.
Fig. 2. South wing, Nunnery at Uxmal.

PLATE VIII

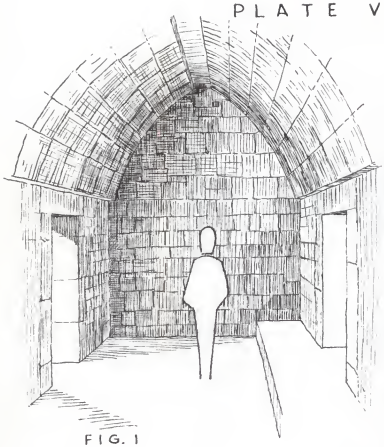


FIG. 1

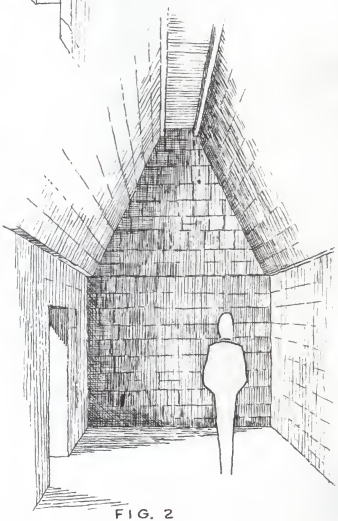


FIG. 2

PLATE IX. Interior Views of Vaulted Chambers.

Fig. 1. East Wing, Nunnery at Uxmal. Small door at left enters second vault.

Fig. 2. Second level chamber, Palace at Sayil. Shows hour-glass shaped column.

Fig. 3. Palace chamber at Palenque. The entrance to second vault is opened up into vault zone creating a more spacious feeling. Notice coffer in ceiling.

PLATE IX

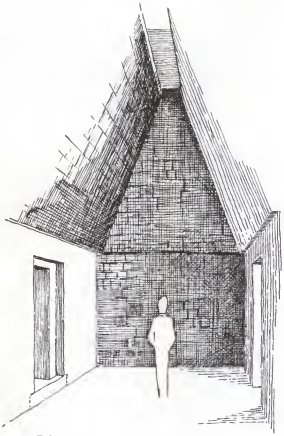


FIG. 1

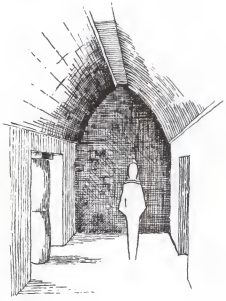


FIG. 2

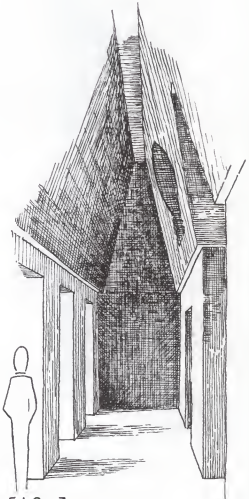


FIG. 3

PLATE X. Exteriors.

Fig. 1. Three-story Palace at Sayil.
Fig. 2. General view of The Codz-Pop (Temple of Masks) at Kabah.
Fig. 3. Close-up of corner of The Codz-Pop.

PLATE X

FIG. 1

FIG. 2

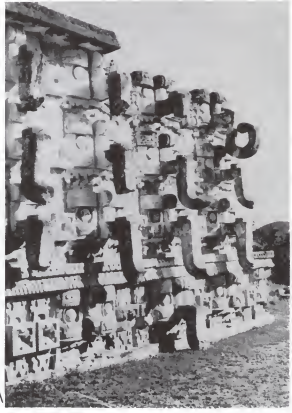


FIG. 3

PLATE XI. Examples of Roof Combs.

Fig. 1. Temple at Labna with roof comb over front wall.
Fig. 2. The so-called Church at Chichen Itza with roof comb over rear wall.
Fig. 3. Temple of the Cross at Palenque with roof comb centered over second vault.
Fig. 4. Temple of the Count at Palenque with roof comb over center bearing wall.

PLATE XI

FIG. 1

FIG. 2

FIG. 3

FIG. 4

PLATE XII. Governor's Palace, Uxmal.

Fig. 1. Close-up of arch connecting central building to south building.
Fig. 2. Plan of Governor's Palace.
Fig. 3. General view of east facade (looking south).

PLATE XII

FIG. 1

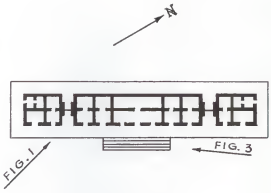


FIG. 2

FIG. 3

PLATE XIII. Temple of Inscriptions, Palenque.

Fig. 1. General view from south showing north main entrance, (c. 692 A.D.).
Fig. 2. Floor plan of Temple.
Fig. 3. Perspective view of entrance chamber.
Fig. 4. Inscription on floor of entrance chamber located at the point of arrow "A" shown in Fig. 2.

PLATE XIII

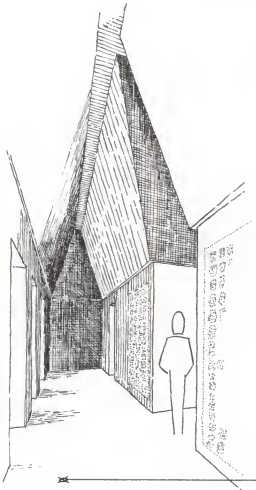


FIG. 3
(PERSPECTIVE FROM POINT "A")

FIG. 1

FIG. 2
SCALE IN FEET 0 8 16 24 32

FIG. 4
(INSCRIPTION INCISED IN STONE FLOOR)

PLATE XIV. Temple of Inscriptions, Palenque.

Fig. 1. Schematic diagram of temple and pyramid.
Fig. 2. View of stairway to tomb, looking down.
Fig. 3. General view of Ruz Romb.

PLATE XIV

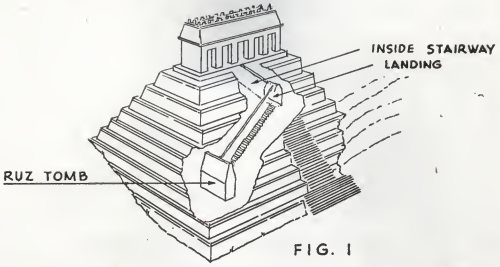


FIG. 1

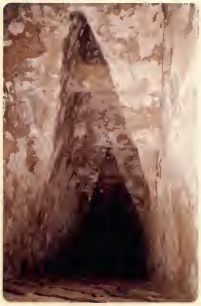


FIG. 2

FIG. 3

PLATE XV. Arch at Labna.

Fig. 1. East elevation of arch.
Fig. 2. Close-up of each elevation showing vault stones.
Fig. 3. West elevation.

PLATE XV

FIG. 1

FIG. 2

FIG. 3

PLATE XVI. Examples of Classic Puuc Proportions.

Fig. 1. Temple of Three Lintels at (old) Chichen.
Fig. 2. Partial elevation of Palace at Labna.

PLATE XVI

FIG. 1

FIG. 2

PLATE XVII. Pyramids and Tower.

Fig. 1. South elevation, Pyramid of the Magician, Uxmal.
Fig. 2. North elevation, Pyramid at Labna.
Fig. 3. Four-story tower within the Palace at Palenque.

PLATE XVII

FIG. 1

FIG. 2

FIG. 3

PLATE XVIII. Modern Mayan House.

Fig. 1. Schematic drawing showing method of construction.

Fig. 2. Photograph of contemporary Mayan house.

PLATE XVIII

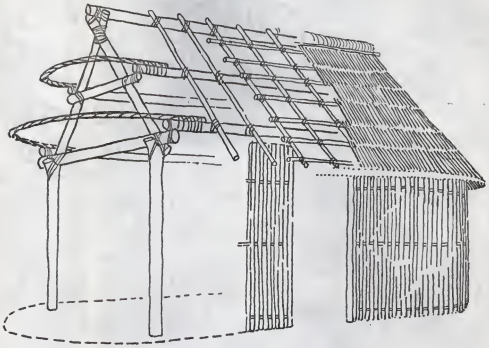


FIG. 1

FIG. 2

PLATE XIX. Architectural Details.

Fig. 1. Three-dimensional lattice block carved into face of stone.
Fig. 2. Three-dimensional lattice carved in the round.
Fig. 3. Eye detail, Rain God Chac, from Xlapak.
Fig. 4. Eye detail, Rain God Chac, from Uxmal.
Fig. 5. Eye detail, Rain God Chac, from Kabah.
Fig. 6. Zig-zag moulding, each piece symbolic of ear of corn.
Fig. 7. Coping detail showing serpent interwound around central belt course.

PLATE XIX

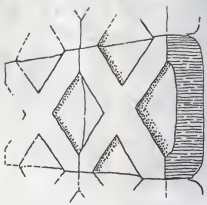


FIG. 1

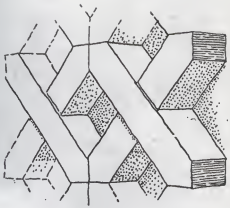


FIG. 2

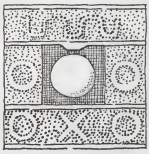


FIG. 3

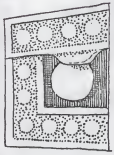


FIG. 4

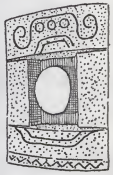


FIG. 5

FIG. 6

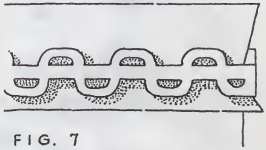


FIG. 7

ACKNOWLEDGMENTS

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MAYAN ARCHITECTURE

by

DICK JORDAN STITH

B. S., Kansas State University, 1951

AN ABSTRACT OF
A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARCHITECTURE

College of Architecture and Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1964

The Classic period of the Mayan civilization spans the years from 300 A.D. to 900 A.D. The area includes virtually all of the Yucatan Peninsula from northern Honduras to the Gulf of Mexico and west to the central part of the State of Chiapas.

The origin of the people of this great culture is unknown; however, it is believed that the first settlements were in the lowlands of central Guatemala about 3000 B.C. By the beginning of the Classic period the Mayas had developed into a great nation based upon city-states with a theocratic government. The country was unified by a common religion rather than a central government.

Probably the most noteworthy achievements of the Mayas would include:

1. An extremely accurate calendar system based upon the solar year, the planet Venus, and other astronomical observations.
2. Origination of the zero concept in mathematics and a number system based upon their solar year calendar.
3. A written language using glyph figures and books (codices) which are not too unlike present-day books in appearance.
4. A sound agricultural system which assured a constant food supply.
5. An architecture with a remarkable quality of art and sculpture, which has survived centuries of weather, overgrowth of jungle, and "stone-robbing".

In this culture the wheel was developed for pull toys for

the children, but was never applied to vehicles which man could use. Beasts of burden were not used even though a number of animals were domesticated for food purposes. Wide stone roads linked principal cities, but these existed primarily for religious processions.

The years of peace produced a heavy population divided into a caste system including rulers, priests, noblemen, craftsmen, and the common people, who were mostly farmers. The latter were required to work on the plantations of noblemen. They shared food, salt, and game and devoted time to the building of the tremendous urban architecture. The great "cities" were really ceremonial centers used for religious purposes and as courts of justice. Residential areas were outside the cities nearer to the farmland.

Before the Classic era, the Mayas experimented with masonry buildings and corbeled vaults. Early in their development they learned the secret of burning lime for plaster, mortar, and stucco. Beginning with block type masonry with stuccoed exteriors and corbeled ceilings or flat ceilings supported by wooden beams, the Mayas gradually refined their building details. Walls of Late Classic buildings have concrete cores faced with stone. Exterior facings were covered with intricate decoration in stone mosaic or sculptured stucco.

The accuracy of Mayan mathematics did not carry over into their architecture. Right angles are rarely ever 90 degrees. Room dimensions vary, but the visual effect appears correct.

Probably no other culture ever developed such showy architecture with such cramped interiors. The clear span of their buildings was, of course, limited to the span of the corbeled vault. So the volume of building materials always exceeded the open chamber space.

The true arch form was unknown to Classic Maya, but this did not produce a stereotyped architecture. Buildings of the same period and geographic area clearly express the originality and individuality of their designer.